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Adherence to Hypertension Management Plans Among Adults in Arar City, Northern Saudi Arabia

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Abstract: **Background:** Hypertension is a major global contributor to cardiovascular morbidity and mortality. Effective management of hypertension relies heavily on patients' adherence to prescribed treatment plans, which include medication use, lifestyle modifications, and regular follow-up. **Aim:** This study aimed to assess the level of adherence to hypertension management plans and identify associated factors among adult hypertensive patients in Arar City, Northern Saudi Arabia. **Methods:** A cross-sectional study was conducted from January 1 to May 31, 2025, involving 400 adult hypertensive patients attending four randomly selected primary health care centers in Arar. Data were collected using a validated, structured questionnaire comprising sociodemographic information, clinical characteristics, and the Hill-Bone Compliance to High Blood Pressure Therapy Scale (HBCHBPTS). Data analysis was performed using SPSS version 25, applying descriptive and inferential statistics, with a significance level set at $p<0.05$. **Results:** The mean age of participants was 44.7±14 years; 57% were female, and 55.8% were married. Approximately 40% of patients demonstrated good adherence, 21.8% had moderate adherence, and 37.4% showed poor adherence. A total of 59% reported co-morbid conditions, 72% attended follow-up appointments regularly, and 57.8% experienced hypertension-related complications, with stroke being the most frequently reported (28.1%). A statistically significant positive correlation was found between age and adherence score ($r = 0.22$, $p<0.001$). **Conclusion:** Only 40% of participants exhibited good adherence to their hypertension management plans. Older age was positively associated with better adherence, while females showed slightly higher adherence than males, though not significantly. Continuous patient education, targeted counseling, and tailored interventions are recommended to enhance adherence, especially among younger and less adherent patients.

Key Words: Hypertension; Medication Adherence; Management Plans; Northern Saudi Arabia; Hill-Bone Scale

INTRODUCTION

Hypertension is one of the most prevalent chronic diseases worldwide and remains a leading cause of cardiovascular morbidity and mortality. Every year, World Hypertension Day—celebrated on May 17th—aims to raise awareness about the prevention, detection, and management of hypertension.[1] Globally, more than one billion people are affected, and the condition continues to represent a significant burden on public health systems [1,2]. The World Health Organization [WHO] identifies hypertension as a major public health issue, affecting approximately 1.4 billion people, with fewer than 15% achieving adequate blood pressure control [3]. It is recognized as the most important modifiable risk factor for cardiovascular disease, particularly in low- and middle-income countries where access to healthcare and preventive programs remains limited [4].

According to the WHO, *adherence to healthcare recommendations* refers to the extent to which a person's behavior—such as taking medication, following a diet, or adopting lifestyle changes—aligns with medical or health advice [5]. In the context of hypertension, adherence encompasses appropriate use of medication, attendance at follow-up appointments, participation in treatment programs, and maintenance of recommended lifestyle

modifications. Conversely, non-adherence occurs when patients fail to follow these therapeutic recommendations, either intentionally or unintentionally [6]. Medication adherence, in particular, plays a central role in achieving blood pressure control and reducing the risk of hypertension-related complications [7].

Despite the availability of effective, evidence-based therapies, hypertension remains a major global health challenge, largely due to suboptimal adherence to prescribed treatments [8,9]. Non-adherence is a critical concern that contributes to poor disease control, increased healthcare utilization, and higher morbidity and mortality rates. It also places a significant economic strain on health systems due to unnecessary hospitalizations and the management of preventable complications [6,10].

Several studies in Saudi Arabia have investigated adherence to antihypertensive therapy, showing considerable variability in adherence rates across regions. In Riyadh, 42.2% of patients reported adherence to antihypertensive medications [11], whereas Alhabib et al. found that only 21.3% of geriatric patients demonstrated good adherence [12]. In the Qassim region, low adherence was reported in 38.8% of cases, while Prabahar et al. in Tabuk found that 76.4% of patients adhered to their medications [13]. In Taif, 86.1% of patients showed high adherence levels [14].

Internationally, studies have demonstrated similarly inconsistent results. Research conducted in India found that 68.2% of hypertensive patients were non-adherent to medication [15]. while a hospital-based study in Iran reported generally low levels of adherence among hypertensive patients [16].

Given the limited data from the northern regions of Saudi Arabia, particularly Arar City, this study aims to assess the level of adherence to hypertension management plans and identify factors influencing adherence among hypertensive patients in Northern Saudi Arabia.

Subjects

Study Setting and Design: A descriptive cross-sectional study was conducted among adult hypertensive patients attending primary health care (PHC) centers in Arar City, Northern Saudi Arabia, between January 1 and May 31, 2025. The study aimed to assess adherence to hypertension management plans using a validated questionnaire.

Study Tool

Data were collected using a predesigned, structured questionnaire consisting of four main components:

- **Sociodemographic characteristics** e.g., age, gender, marital status, education, and occupation
- **Hypertension management and long-term complications**, including medication use, follow-up behavior, and disease-related outcomes
- **Adherence assessment** using the *Hill-Bone Compliance to High Blood Pressure Therapy Scale (HBCHBPTS)*
- The HBCHBPTS is a validated instrument with strong psychometric properties for evaluating adherence among hypertensive patients [17]. It includes 14 items divided into three subscales:
  - Reduced salt intake
  - Appointment keeping
  - Medication-taking behavior

Each item is scored on a four-point Likert scale, ranging from 1 = all the time to 4 = none of the time. Higher scores indicate better adherence. It should be noted that selecting *"all the time"* indicates non-adherence behavior. The total possible score ranges from 14 to 56, with higher totals reflecting higher adherence levels.

Previous studies classified adherence into three levels: poor (<70%), moderate (70–80%), and good (>80%) adherence to hypertension management plans (18–20).

Questionnaire Validity and Reliability

The original questionnaire was prepared in English, translated into Arabic by a bilingual expert, and then back-translated into English to ensure consistency. Its content validity was reviewed by two family medicine specialists. A pilot study was conducted with 20 hypertensive patients to evaluate the clarity, relevance, and time required to complete the questionnaire; no modifications were necessary afterward. Data from the pilot phase were excluded from the final analysis.

The questionnaire began with a brief description of the study objectives and included a statement of informed consent. Participation was voluntary, and data were collected electronically through a self-administered Google Form distributed via WhatsApp.

Sampling Method and Sample Size

Participants were recruited through a convenience sampling technique from four randomly selected PHC centers, representing the northern, southern, eastern, and western regions of Arar City.

The sample size was calculated using the formula:

$$N=Z^2\times P(1-P)/d^2$$

Where, N is the required sample size, Z = 1.96 for a 95% confidence level, P = 0.772 (estimated adherence prevalence from a previous study) [18], and d = 0.05 (precision). The calculated minimum sample size was 350. After accounting for potential non-responses, the final sample size was increased to 400 participants.

Inclusion and Exclusion Criteria

Inclusion criteria: Adult patients (≥18 years) diagnosed with hypertension who attended the selected PHC centers and consented to participate in the study.

Exclusion Criteria

Patients who declined participation or failed to complete the questionnaire were excluded.

Ethical Considerations

Ethical approval was obtained from the Northern Border University Local Bioethics Committee (HAP-09-A-043) on January 30, 2025, under decision number (9/25/H). Participation was voluntary, and data confidentiality was maintained throughout the study.

RESULTS

Table 1 The current research included 400 participants, with a mean age of 44.7±14, approximately fifty percent between the ages of 40–50 years old, slightly less than sixty percent females (57%), more than half married (55.8%), fifty percent university graduates, and over forty percent in governmental jobs.

Table 1: Sociodemographics of the Study Respondents

Item	No	Percentage
Age /years		
18-39	138	34.5
40-59	195	48.8
≥60	67	16.8
Gender		
Male	172	43
Female	228	57
Marital status		
Single	72	18
Married	223	55.8
Divorced	64	16
Widowed	41	10.3
Education		
Illiterate	33	8.3
Primary School	59	14.8
Intermediate School	43	10.8
High School	66	16.5
University	173	43.3
Postgraduate Study	26	6.5
Occupation		
I don't work	103	25.8
Governmental	172	43.0
Private	40	10.0
Retired	64	16.0
Others as freelancers	21	5.3
Do you currently smoke?		
Yes	192	48
No	208	52.0
Do you practice regular exercise?		
Yes	195	48.8
No	205	51.3
Family history of hypertension		
Yes	289	72.3
No	111	27.8

The mean age = 44.7±14

Table 2 displays hypertension management and long-term complications among study patients. More than two-thirds of the participants mentioned that they received one pill for the treatment of hypertension (68.3%), slightly less than sixty percent (59%) answered that they suffered from co-morbidities, somewhat more than 70% scheduled follow-up appointments with the physician frequently, about 60% believed that adherence to treatment plan can reduce the complications, and a significant proportion stated that they noticed an improvement in their health status due to consistent adherence.

Slightly less than sixty percent responded that they experienced hypertension-related complications, and the stroke was the most mentioned (28.1%), followed by visual problems (23%), heart attack (17.3%), and renal impairment (14.7%).

Figure 1 showed that around forty percent (163) of patients had good adherence, whereas 87(21.8%) and 150(37.4%) had intermediate and poor adherence, respectively.

Figure 2 demonstrated a significant (p-value <0.001) positive correlation (r = 0.22) between age and hypertension adherence score.

Table 3 highlights the association between sociodemographic characteristics, hypertension management, and adherence among research participants. The following socio-demographic characteristics were associated with good adherence: age group 40–59 years, married (71.2%), university educated (50.9%), government

Table 2: Hypertension Management and Long-Term Complications Among the Studied Participants

Item	No	%
How many antihypertensive pills do you take per day?		
One pill	273	68.3
Two or more	127	31.8
The presence of co-morbidities (other medical conditions)?		
Yes	236	59
No	164	41.0
Do you schedule follow-up appointments with your doctor frequently?		
Yes	288	72
No	112	28
Do you believe adherence to your management plan reduces the risk of complications?		
Strongly agree	242	60.5
Agree	136	34
Neutral	22	5.5
Have you noticed any improvement in your health due to consistent adherence?		
Yes, significant improvement	295	73.7
Some improvement	89	22.3
No improvement	16	4
Have you experienced any complications related to hypertension?		
Yes	231	57.8
No	169	42.3
If yes, please specify*		
Stroke	65	28.1
Vision problems	53	23
Heart attack	40	17.3
Kidney disease	34	14.7
Others include Headache, Stress, and palpitation	39	16.9

*No 231

Table 3: The Association of Hypertension Adherence with Sociodemographic Features and Hypertension Management among the Investigated Respondents

Items	Good adherence No (%) n=163	Moderate adherence No (%) n=87	Poor adherence No (%) n=150	p-Value
Age groups /years				
18-39	32(19.6)	33(38)	73(48.7)	0.000
40-59	88(54)	47(54)	60 (40)	
≥60	43(26.4)	7(8)	17(11.3)	
Gender				
Male	73(44.8)	34(39.1)	65(43.3)	0.6
Female	90(55.2)	53(60.9)	85(65.7)	
Marital status				
Single	20(12.2)	17(19.5)	35(23.3)	0.000
Married	116(71.2)	57(65.6)	50(33.4)	
Divorced	27(16.6)	13(14.9)	65(43.3)	
Education				
Illiterate	18(11)	5(5.6)	10(6.7)	0.000
Primary	15(9.2)	10(11.5)	34(22.7)	
Intermediate	7(4.3)	8(9.2)	28(18.7)	
High School	28(4.3)	10(9.2)	28(18.7)	
University	83(50.9)	49(56.4)	41(27.2)	
Postgraduate	12(7.3)	5(5.7)	9(6)	
Occupation				
I don't work	48(29.4)	29(33.3)	26(17.3)	0.000
Governmental	73(44.8)	39(44.9)	60(40)	
Private	6(3.7)	5(5.7)	29(19.4)	
Retired	29(17.8)	12(13.8)	23(15.3)	
Other	7(4.3)	2(2.3)	12(8)	
Family history of hypertension				
Yes	95(58.3)	66(75.9)	128(85.3)	0.000
No	68(41.7)	21(24.1)	22(14.7)	
Smoking				
Yes	45(27.6)	33(38)	114(76)	0.000
No	118(72.4)	54(62)	36(24)	
Exercise regularly				
Yes	49(30.1)	32(36.8)	114(76)	0.000
No	114(69.9)	55(63.2)	36(24)	
Comorbidities exist				
Yes	74(45.4)	40(46)	122(81.3)	
No	89(54.6)	47(54)	28(18.7)	0.000
The presence of Complications				
Yes	57(35)	49(56.3)	125(83.3)	0.000
No	106(65)	38(43.7)	25(16.7)	
Do you have regular follow-up appointments with your doctor?				
Yes	113(69.3)	47(54)	128(85.3)	0.000
No	50(30.7)	40(46)	22(14.7)	
How many antihypertensive medicines do you take every day?				
One pill	126(77.3)	61(70.1)	86(57.3)	0.001
Two or more	37(22.7)	26(29.9)	64(42.7)	

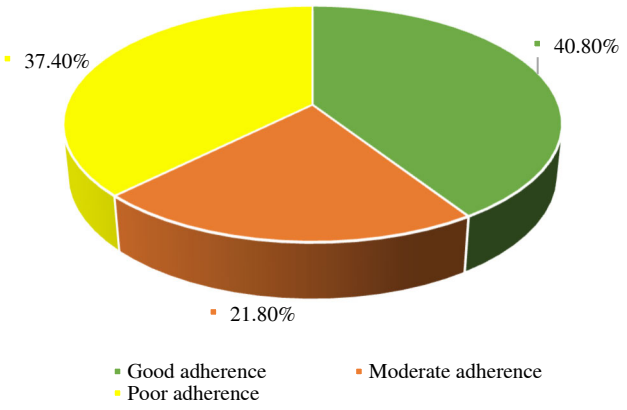

Figure 1: Hypertension Adherence Among the Study Participants

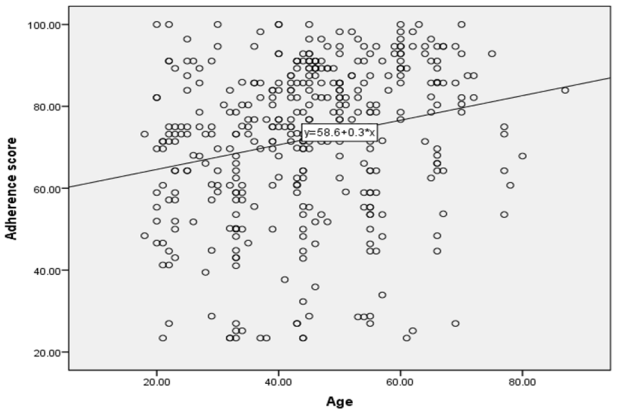

Figure 2: Correlation between Age and Hypertension Adherence Score

employee (44.8%), family history of hypertension (58.3%), and non-smokers (72.4%). Females had non-significantly higher rates of good adherence (55.2%) than males.

The majority of poorly adherent patients reported the existence of comorbidities (81.3%) and complications (83.3%).

DISCUSSION

Hypertension management remains a complex challenge that requires strict adherence to both pharmacological and non-pharmacological interventions. Medication adherence is a cornerstone in the long-term management of chronic diseases such as hypertension, yet non-adherence continues to be a major obstacle for healthcare providers. The present study assessed adherence levels among hypertensive patients in Northern Saudi Arabia using the Hill-Bone Compliance to High Blood Pressure Therapy Scale.

In this study, approximately 40% of participants demonstrated good adherence, while 21.8% and 37.4% showed moderate and poor adherence, respectively. The relatively modest proportion of good adherence may partly be explained by the multidimensional nature of the Hill-Bone scale, which evaluates not only medication intake but also salt reduction and follow-up appointment behaviors—factors that can lower the overall adherence score.

The present findings are consistent with previous studies conducted in Saudi Arabia and neighboring regions. For instance, in Riyadh, 42.2% of patients adhered to their antihypertensive therapy [21] Similarly, Thirunavukkarasu et al. in Abha, southern Saudi Arabia, found high and moderate adherence levels of 36.3% and 31.8%, respectively [22] In Al Jouf, Alruwaili reported 59% of participants with moderate to good adherence [23], while adherence levels in Almadinah Almunawwarah and Taif were 35.1% and 35%, respectively [24,25] Comparable results were also observed internationally, such as in Ethiopia, where 36% of respondents demonstrated high adherence [26].

However, the present adherence rate is higher than those reported in Makkah, where 23.5% and 22.5% of participants exhibited medium and high adherence, respectively [27] Lower adherence rates were also reported in India (27.4%) [28], Morocco (9%) [29], and a multinational study in Jordan and Lebanon (low adherence in 44% of participants) [30] In Bangladesh, only 7% of hypertensive patients achieved good adherence [20].

Conversely, the findings are lower than those observed in other Saudi studies, such as that by Alhabib et al. in Riyadh, which documented 64.9% excellent adherence [12] Similarly, Farah et al. in Jordan found that 63.8% of participants had good adherence [31], and another Jordanian study reported 82.8% strong adherence [19] Such discrepancies may result from differences in adherence assessment tools, patient characteristics, healthcare accessibility, and sampling strategies.

The observed variation in adherence levels across developing countries could also stem from the absence of standardized adherence measurement instruments and differences in study designs, populations, and sociocultural contexts. Studies from developed nations have generally reported higher adherence levels, such as in Sweden (87.3%) [32], the United States (64%), France (64%) [33], Canada [34], and the Netherlands [35]. These higher adherence rates may be attributed to better health literacy, comprehensive healthcare systems, and stronger patient support programs.

A statistically significant positive correlation was found between age and adherence scores, indicating that older adults tend to follow their treatment regimens more consistently. This finding aligns with earlier national studies conducted in Riyadh [36] and Makkah [27], as well as international evidence [37,38] The higher adherence among older individuals may be explained by the availability of caregivers and greater health awareness resulting from longer exposure to healthcare services. In contrast, younger and middle-aged adults may experience occupational and social constraints that reduce their ability to comply with treatment plans.

Although females in this study demonstrated slightly higher adherence levels than males, the difference was not statistically significant. This trend is consistent with findings from Jordan [39] India [40 Lebanon, and Jordan [30,31] though it contrasts with other Saudi research indicating lower adherence among females. [27] Gender differences in adherence may be influenced by cultural, behavioral, and psychosocial factors that vary between populations.

Educational status was also found to influence adherence, with lower adherence levels among less educated participants. This observation aligns with studies from Lebanon [30] the United States [41] and Korea [42] which have shown that higher educational attainment is associated with greater health literacy and improved medication-taking behaviors. However, this result contradicts a study from Jordan where education level did not significantly affect adherence [19].

Marital status was another factor associated with adherence; married individuals showed better adherence than unmarried participants. This finding is consistent with studies conducted in Egypt [43] Lebanon [30] and Turkey [44] suggesting that social and emotional support from family members may positively influence medication adherence and follow-up compliance.

Study Limitations

Although this study provides valuable insight into adherence to hypertension management plans among patients in Northern Saudi Arabia, several limitations should be considered. First, the cross-sectional design limits the ability to establish causal relationships between adherence and associated factors. Second, data collection relied on self-reported responses, which are susceptible to recall and social desirability bias. Third, the convenience sampling technique may have introduced selection bias, as participants who attend primary health care centers regularly might already exhibit higher adherence levels than the general hypertensive population. Lastly, the electronic data collection method (via

WhatsApp) may have excluded individuals with limited technological access or literacy, thereby affecting representativeness.

CONCLUSIONS

Approximately 40% of the participants in this study demonstrated good adherence to hypertension management plans. Older age was significantly associated with higher adherence levels, while females showed marginally better adherence than males. Educational attainment, marital status, and absence of comorbidities were also positively related to adherence behavior.

To improve adherence rates, continuous patient education and individualized counseling are essential, particularly for younger and less adherent patients. Interventions should emphasize the importance of regular medication intake, lifestyle modification, and scheduled follow-ups. Furthermore, incorporating telemedicine and digital health platforms into patient follow-up may enhance continuity of care and self-management. Future research should explore the underlying causes of poor adherence through longitudinal and interventional studies to guide evidence-based public health strategies.

Authors' Contributions

Mohamed M. Abd El Mawgod: Study conception, data analysis, software, and manuscript drafting. Farah Salamah F. Alanazi, Fatimah Naif S. Alruwaili, Balasim Ayyadah D. Alanazi, Reema Mubarak O. Alanazi, and Noura Fayez K. Alrawili: Study design and data collection. All authors reviewed and approved the final manuscript.

Data Availability

Data supporting the findings of this study are available upon reasonable request from the corresponding author.

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